**1st Assignment**

**CS330 Discrete Structures, Fall 2015**

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**Problems**

1. **Page 35, exercise 8,**

**Use De Morgan’s laws to find the negation of each of the following statements.**

1. **Kwame will take a job in industry or go to graduate school.**

Kwame will not take a job in industry and go to graduate school.

1. **Yoshiko knows Java and calculus.**

Yoshiko doesn’t know java or Yoshiko doesn’t know calculus

1. **James is young and strong.**

James is either not young or not strong

1. **Rita will move to Oregon or Washington.**

Rita will not move to Oregon and Washington.

1. **Page 35, exercise 14,**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| p | q | p->q | ¬ p | ¬ q | ¬ p^(p->q) | (¬ p^(p->q) )-> ¬ q |
| T | T | T | F | F | F | T |
| T | F | F | F | T | F | T |
| F | T | T | T | F | T | F |
| F | F | T | T | T | T | T |

Due to the truth table, this is not tautology.

1. **Page 35, exercise 22,**

(p->r) ^ (q->r) ⬄ (¬p V r) ^ (¬q V r) ⬄ r V (¬p^¬q)⬄r V ¬ (p V q) ⬄ (p V q) -> r

so they are logically equivalent.

1. **Page 35, exercise 24,**

(p->q)V(p->r) ⬄(¬pVq)V(¬pVr)⬄ ¬pV(qVr)⬄p->(qVr)

So, they are logically equivalent

1. **Page 36, exercise 44 (you need to use the solutions for exercise 42, 43 here).**

By De Morgan’s laws, ¬(¬p∨¬q) ⬄ ¬¬p∧¬¬q ⬄ p∧q

So every logical statement using the ∧ operator can be rewritten in terms of the ∨ and ¬ operators. Since every logical statement can be expressed in terms of the ∧, ∨, and ¬ operators, this implies that every logical statement can be expressed in terms of the ∨ and ¬ operators, and so {∨, ¬} is functionally complete.